REMARKS

Claims 1-29 and 49-50 were examined and rejected. Claims 30-37 were previously withdrawn, and are cancelled herein. Claims 38-48 have been previously canceled. Applicants amend no claims. Applicants respectfully request reconsideration of claims 1-29, 49 and 50, in view of at least the following remarks.

I. Claims Rejected Under 35 U.S.C. §102

The Patent Office rejects claims 1-5, 7, 14, 16-18 and 20-26 under 35 U.S.C. § 102(b) as being anticipated by WO 02/067014 to Harel et al. ("Harel"). It is axiomatic that to be anticipated, every limitation of a claim must be disclosed within a single reference.

Applicants respectfully disagree with the rejection above of claim 1, for at least the reason that the cited references do not teach or suggest a photodetector comprising a heterojunction formed of two semiconductor materials, being halides, wherein at least one of the first and second semiconductor materials consist of a semiconductor material, as required by claim 1. According to claim 1, for example and without providing limitation thereto, both of the semiconductor materials are halides; and one of the two materials that form the heterojunction is a semiconductor material, excluding other elements from having substantial; significance to the semiconductor material, i.e. excluding other elements that would affect the basic characterization of the layer as a semiconductor material, as opposed to, for example, the prior art layers that may contain particles of a semiconductor.

On the other hand, Harel teaches producing wide band gap semiconductor particle-in-binder (PIB) composite detectors having particulate semiconductors combined with polymeric binders. (See page 4, lines 1-3) Specifically, Harel describes grains of mercuric iodide powder mixed with a binder, such as acrylic, ester derivatives, rubber, polymers, etc. (See page 19-20, lines 6-7) The material is mixed thoroughly to wet all of the particles of mercuric iodide powder and to obtain a homogenous mixture (see page 20, lines 6-7) which is then applied to an adhesive coated substrate by screen printing die pressing, doctor blade, slot coater, or Mayer rod (see page 20, lines 8-16; page 14, lines 9-11; and page 15, lines 15-18). Moreover, Harel teaches a

photoconducting hybrid bi-layer detector plate 10 having a primary layer of mercuric iodide (5) over a buffer layer of lead iodide (4) (see page 30).

However, the Patent Office has not identified and Applicants are unable to find any description in Harel that teaches or suggests a heterojunction of two halides, and at least one material that consists of a semiconductor material, as required by claim 1. As known in the art, such a semiconductor material has a band gap, such as those given in paragraph 34 of Applicants' specification for materials that are halides and consist of the specific semiconductor materials mentioned, but does not have a band gap of a particle-in-binder (PIB) material as taught by Harel (See page 4, lines 1-3 of Harel). Moreover, as know in the art, a halide material or a material that consists of a semiconductor material, may be formed by various techniques including chemical vapor deposition (CVD), sputter, and ion beam deposition (e.g., as noted in paragraph 35 of the Applicants' specification as filed), but are not formed of particles of semiconductor material mixed with binder material as taught by Harel (See **Figures 12-13** of Harel contrasting the sensitivities of PIB semiconductor materials as compared to CVD semiconductor materials).

For instance, it can be appreciated that the particles of mercuric iodide powder, wet with the binder in a homogenous mixture of Harel will not dry to form a halide or a material that consists of a semiconductor material. Although the PIB composite may include, on occasion, attached halide particles at various locations, the material will also include binder which has an essential significance to the halide or semiconductor material by effecting its band gap and conductivity. For instance, Harel teaches a binder, such as a Polymeric Binder as part of the imaging composition existing in a radiation detector plate (see Harel page 4). Thus, binder will exist between some of the semiconductor particles within the plate. Hence, it is not disclosed or necessary that the PIB material be a halide or a material that consists of a semiconductor material because the binder material will exist at locations between the particles of Harel.

Moreover, to this end, Harel teaches that PIB semiconductor materials provide different conduction sensitivity than physical vapor deposition (PVD) semiconductor materials (e.g., PVD materials, without limitation thereto, are an example of a halide or a material that consists of a semiconductor material) (see Harel pg. 14 paragraph 3; and Figures 6, 12, and 13). This difference in conduction is one motivation behind the invention of Harel. Specifically, the Patent

Office has not identified and Applicants are unable to find any disclosure in Harel of layers consisting of a semiconductive material as claimed (see, Harel, pg. 19, last para. through pg. 18, first para.). For instance, Harel teaches polystyrene in toluene mixed thoroughly with mercuric iodide powder to obtain a homogeneous mixture (see, Harel, pg. 20, lines 6-7). As a result, Harel teaches non-halide, non-conductive binder existing between the particles along the junction of Harel. Hence, for at least the reasons above, the reference does not teach or suggest the limitations above, and Applicants respectfully request the Patent Office withdraw the rejection of claim 1 above.

Also, the background of Harel indicates that single crystal or polycrystalline semiconductor structures (e.g., which without limitation thereto, are a type of semiconductor material that consists of a semiconductor material as claimed), have disadvantages which the PIB composite improves. Thus, Applicants believe that upon reading the background and other sections of the specification of Harel, a practitioner in the art would not be motivated to create the halides or the material that consists of a semiconductor material claimed in Applicants' independent claims, since the single crystal or polycrystalline semiconductor structures are what the PIB composite of Harel is designed to replace.

In fact, since the purpose of the PIB composites of Harel is to use the PIB composites in place of single crystal materials or polycrystalline materials (e.g., solid phase semiconductor films) to improve the shortcomings of single crystal materials or polycrystalline materials (see background of Harel), Harel teaches against halides or a material that consists of a semiconductor material. Specifically, Harel teaches a radiation detector plate including a composition layer comprising an addmixture of particulate semiconductor with a polymeric binder (see, Harel pg. 4, para. 2), to allow for better direct X-ray radiation to electrical signal conversion that in prior art converters, while having a sensitivity close to the order of magnitude obtained by polycrystalline detector plates and imagers produced by PVD-type processes (see, Harel pg. 3, 1st para. of Summary of Invention Section). Harel also points out that the primary PIB layer has a sensitivity only 40-50% of that of non-composite polycrystalline HgI2-PVD produced imagers (see page 18 paragraph 3 and Figure 6).

Thus, Harel distinguishes its PIB composite from halides or the material that consists of a semiconductor material, and identifies its PIB composite as an improvement to those materials,

although less sensitive. Specifically, at page 2 paragraph 1 Harel described that composite imagers, such as imagers made of a composite of particles and binders (*e.g.* PIB imagers, see page 4, paragraphs 1 and 2) are different than physical vapor deposition (PVD) imagers of the same semiconductor, and that the PIB invention allows for better direct X-ray radiation to electrical signal conversion (see page 3, paragraph 1 of Summary of Invention). Thus, the composite imagers of Harel teach PIB type imagers which Harel distinguishes from and teaches against halides or compound materials that consists of a semiconductor material, such as those claimed in claim 1 (also see Harel Figures 6, 12, and 13).

Hence, for at least the reasons above, including the reason that Harel teaches against the limitations above of claim 1, Applicants respectfully request the Patent Office withdraw the rejection of claim 1 above.

In addition to being based on an allowable base claim, Applicants also disagree with the rejection of dependent claims 2 and 4 for the additional reason that it is not implicit that Harel's semiconductor materials also have approximately the same bandgap. As noted above, Harel teaches particle in binder material. Thus, Applicants respectfully request the Patent Office provide a reference in support of the particle in binder materials of Harel having approximately the same bandgap as a halide material consisting of a semiconductor, as claimed. (e.g. see MPEP § 2144.03)

In addition to being based on an allowable base claim, Applicants also disagree with the rejection of dependent claims 17-18 for the additional reason that the particle in binder materials of Harel do not describe bandgaps within ten percent of each other as required by claims 17 and 18. An argument analogous to the one above for claim 2 applies here as well.

II. Claims Rejected Under 35 U.S.C. §103

The Patent Office rejects claims 11-13, 15 and 19 under 35 U.S.C. § 103 (a) as being unpatentable over Harel. For a claim to be obvious every limitation of that claim must be taught by at least one properly combined reference.

Applicants respectfully disagree with the rejection of dependent claims 11-12 and 15 for at least the reasons provided herein in support of their base claims, as well as the additional limitations of those dependent claims.

In addition to being based on an allowable base claim, Applicants also disagree with the rejection of claims 11-12 and 15 for the additional reason that the ranges required by those claims provide benefits that are not taught or enabled by any of the references. For example, a thicker layer of the second semiconductor material allows benefits of a more sensitive second material to provide greater detection, as compared to a thinner layer of the first material which may be used to protect the electrodes from the more reactive second material (e.g. such as when the first material is lead iodide and the second material is mercuric iodide, or as otherwise described in paragraphs 26-27, 30, and 32 of the application).

Applicants disagree with the rejection above of independent claim 13 for at least the reason that the references do not teach or enable "a plurality of semiconductor materials forming a heterojunction, the plurality of semiconductor materials comprising: ...second semiconductor material coupled to the first semiconductor material, the first and second semiconductor materials being halides," as required by claim 13. An argument analogous to the one above for claim 1 applies here as well.

Moreover, Harel does not teach, but claim 13 requires that the first semiconductor material has a first thickness less than approximately 50 microns, the second material has a thickness greater than approximately 250 microns, and a third material comprising lead iodide coupled to the second material has a thickness less than approximately 50 microns, as required by claim 13. An argument analogous to the one above for claims 11-12 and 15 applies here as well. As noted above for claims 11-12 and 15, these thicknesses provide benefits that the references do not teach or enable. Thus, Applicants respectfully request the Patent Office provide a reference in support of its position regarding the thicknesses of claim 13, in accordance with MPEP § 2144.03.

Applicants disagree with the rejection above of independent claim 19 for at least the reason that the cited references do not teach or enable "a plurality of semiconductor materials forming a heterojunction, the plurality of semiconductor materials comprising: ...second

semiconductor material coupled to the first semiconductor material, the first and second semiconductor materials being halides," as required by claim 19. An argument analogous to the one above for claim 1 applies here as well.

In addition, Applicants disagree with the rejection of claim 19 for at least the reason that the cited references do not teach "wherein the bandgaps of the first and second semiconductor materials are within ten percent of each other," as required by claim 19. An argument analogous to the one above for claims 2 and 4 applies here as well.

Moreover, applicants disagree with the rejection of claim 19 for at least the reason that non of the cited references teach or enable wherein the second semiconductor material is thicker than the first semiconductor material, as required by claim 19. An argument analogous to the one above for claims 11-12 and 15 applies here as well. As noted above for claims 11-12 and 15, these thicknesses provide benefits that the references do not teach or enable. Thus, Applicants respectfully request the Patent Office provide a reference in support of its position regarding the thicknesses of claim 19, in accordance with MPEP § 2144.03.

The Patent Office rejects claims 1-5, 7-10, 14, 16-18, 24-29 and 49-50 under 35 U.S.C. § 103 (a) as being unpatentable over U.S. Patent No. 6,437,339 to Lee et al. ("Lee").

Applicants respectfully disagree with the rejection above for at least the reason that Lee does not teach or enable "a plurality of semiconductor materials forming a heterojunction, the plurality of semiconductor materials comprising: ... second semiconductor material coupled to the first semiconductor material, the first and second semiconductor materials being halides," as required by claim 1.

Lee describes a primary purpose of being able to provide x-ray images at low x-ray exposure levels (see Abstract and col. 3, lines 65-67) using the principles of operation of (1) amplifying the charge output of photoconducting material 300 using emission layer 400 and thin gas chamber 500; or (2) amplifying the charge output by layer 2300 using gain layer 2500 (see col. 2, lines 32 – col. 4, line 56). However, Lee only describes and only enables using selenium for layer 300 or for layer 2300 as satisfying the above-noted principles of operation and primary purpose (see col. 3, lines 6-14; col. 4, lines 1-3; col. 4, lines 45-47). Specifically, for amplifying

the charge output by layer 2300 using gain layer 2500, Lee only discloses that layer 2300 "carries out a function similar to that of layer 300" (see col. 4, lines 31-32), and only describes layer 2300 as amorphous selenium (see col. 4, lines 45-47).

However, the Patent Office has not identified and Applicants are unable to find any teaching or enablement in Lee of a heterojunction of a first halide material coupled to a second halide material, as required by claim 1.

In addition, each teaching in Lee requires a charge multiplying gain layer, which leads to photoconductive gain (charge multiplication within the gain layer) which can be problematic because it leads to increased noise and degraded image quality. On the other hand, by including the claimed heterojunction of a second semiconductor halide material coupled to the first semiconductor halide material, embodiments described in the specification of the present application, for example, without limitation thereto, may provide one or more benefits of: (1) collecting charge and then amplifying the charge (see paragraph 39 of the application); (2) choosing a bias voltage to determine the sensitivity of the detector (see paragraph 39 of the application); and (3) using amplifiers 519 to drive analog to digital converters (see paragraph 40 of the application), thus avoiding photoconductive gain (charge multiplication) and avoiding increased noise and degraded image quality. Consequently, Lee does not provide such benefits, as Lee requires the charge multiplying gain layer. Thus, a practitioner would not consider Lee for teaching the above noted claims; and would not consider combining Lee with another reference to teach those claims.

As noted above, Applicants respectfully request the Patent Office provide a reference in support of the position that a particle in binder is equivalent to a material that is a halide, as required by the claims, in accordance with MPEP § 2144.03.

Applicants also disagree with the rejection of dependent claims 8-10 as being obvious in view of lee for the additional reason that the thicknesses claimed in claims 8-10 would not have been obvious in view of Lee for at least the reason that Lee does not provide the above noted benefits with respect to claim 11-12 and 15 as argued above.

Applicants also disagree with the rejection of dependent claims 24-26 for the additional reason that substituting lead iodide for mercuric iodide would not have been obvious, since such materials are not recognized equivalents (e.g., see paragraphs 26-27, 30, and 32 of the application). Applicants, respectfully request the Patent Office provide a reference in support of its position that lead iodide is equivalent to mercuric iodide, in accordance with MPEP § 2144.03. Specifically, as described above for claims 11-12 and 15, and in Applicants specification, mercuric iodide is more reactive with the electrodes, and is more sensitive than lead iodide.

Similarly, Applicants respectfully disagree with the rejection above of claim 49, for at least the reason that Lee does not disclose a photodetector comprising <u>a heterojunction formed of two semiconductor materials</u>, being halides, wherein at least one of the first and second semiconductor materials <u>consist essentially of a semiconductor material</u>, as required by claim 49.

An analogous to the one above for claim 1 applies here as well.

In addition to being dependent on allowable base claim 1, Applicants disagree with the rejection above of claim 14 for at least the reason that Lee does not disclose "wherein the plurality of semiconductor materials further comprises a third semiconductor material comprising lead iodide coupled to the second semiconductor material," as required by claim 14.

The Patent Office cites col. 2 lines 32-40 of Lee against the above limitation stating "(the charge generation layer 300 or 2300 can be Hgi2, PbI2, a-selenium, others, and combination or subcombination thereof)." Applicants disagree. First, Lee only states "Layer 300 can comprise, for example, amorphous selenium, PbI.sub.2, CdTe, CdZnTe, TIBr, HgI2, silicon, germanium, PbO2, with or without doping materials, and combinations or subcombinations thereof," but does not describe layer 300 as more than a single layer of material. Also, as noted above for claim 1, for layer 300 or 2300, Lee only describes a single layer of a-selenium as satisfying the primary purpose and principles of operation of Lee (see col. 3, lines 6-14; col. 4, lines 1-3; col. 4, lines 45-47).

Consequently, the Patent Office has not identified and Applicants are unable to find any disclosure in Lee of the above-noted 3-layer limitations of claim 14.

In addition to being dependent on allowable base claim 1, Applicants disagree with the rejection above of claim 28 for at least the reason that Lee does not disclose "wherein the first contact is coupled to ground and the second contact is coupled to a negative voltage," as required by claim 28.

As shown in Figures 1 and 3 of Lee, the negative bias is applied to layer 300 or 2300, while a positive voltage is applied to collector electrode 600. However, the Patent Office has not identified and Applicants are unable to find any disclosure in Lee of the above-noted limitation of claim 28.

Applicants submit that any dependent claims not mentioned above, being dependent upon allowable base claims, are patentable over the cited references for at least the reasons explained above as well as additional limitations of those dependent claims.

Thus, Applicants respectfully request that the Patent Office withdraw the rejection of all claims as being unpatentable over the cited references.

CONCLUSION

In view of the foregoing, it is believed that all claims now are now in condition for allowance and such action is earnestly solicited at the earliest possible date. If there are any additional fees due in connection with the filing of this response, please charge those fees to our Deposit Account No. 02-2666.

PETITION FOR EXTENSION OF TIME

Per 37 C.F.R. 1.136(a) and in connection with the Office Action mailed on September 19, 2008, Applicants respectfully petition Commissioner for a one (1) month extension of time, extending the period for response to January 19, 2008. The amount of $130.00 to cover the petition filing fee for a 37 C.F.R. 1.17(a)(1) large entity will be charged to our Deposit Account No. 02-2666.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Dated: 01/2/09

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CERTIFICATE OF TRANSMISSION

I hereby certify that this correspondence is being submitted electronically via EFS Web to the United States Patent and Trademark Office on the date below.

Jessica M. Huester 01/02/09
Date